Limits to international diversification in oil and gas -domestic vs foreign asset control

Limits to International Diversification in Oil and Gas Domestic vs Foreign Asset Control

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Evidence is provided of the effects of international diversification on global asset ownership and control. We show that international geographic diversification in the oil and gas sector comes at an important cost, lower control over foreign oilfield assets relative to domestic assets (and therefore reduced control over oilfield cash-flows). This work examines this contradiction. Detailed worldwide oilfield ownership data for 293 companies owning 6,633 field stakes enables us to isolate variables underpinning asset ownership, demonstrating that international diversification increases with firm size, but is negatively related to asset control. We argue that companies seeking reserve replacement are forced to diversify and therefore need to be prepared to obtain lower control over oilfield cashflow. We find an important caveat; companies retain minimum blockholding in foreign investments.

I Introduction

Our study addresses the effect of global oil and gas diversification on asset control, adding contrary insights into the value of blockholdings in the most important global extractive industry, oil and gas (O&G). We find that geographic diversification leads to diminishing control over asset cash flows, leading to an implied but clear cost to international diversification strategies. Our O&G findings contrast with those for the tobacco industry by Beneish et al. (2008) who document that diversifying acquisitions by tobacco firms are positive net present value (NPV) investments, and that wealth creation increases with the degree of domestic geographic expansion, apparently this occurs as a result of increasing tobacco firms' influence in political districts. Rose (1996) also studies geographic diversification and the cost effects of interstate banking in the US. He finds that when banking firms are grouped into different levels of geographic diversification, highly diversified interstate banks appear to achieve reductions in risk exposure, operating costs and therefore benefit from geographic diversification.

The existing body of literature infers that stock blockholders are able under certain circumstances, to exercise undue influence over cash flows. The result is that corporate blockholdings come at a control premium. Interestingly for listed corporates these blockholdings typically comprise between 5-10% of shares (see Holderness (2007)). Prior research has also made the point that blockholding value occurs particularly where minorities are not protected (see Durnev and Kim (2007) for a discussion of minority investor protection).

In O&G we see no such benefits; global diversification in the O&G industry increases political risk, particularly for OECD producers. Cross border cost reductions are difficult to achieve and complex to analyze in that they combine technical field risks and fiscal regimes, both of which vary by jurisdiction. Simply put, we suggest that despite reasons, which have previously supported expansion, in O&G these are reasons not to diversify. So, why then do O&G companies diversify? The simple answer seems to be that they have to in order to replace reserves. But, our contribution is that we suggest that for the O&G industry this comes at an important implied cost, reduced control over foreign assets.

O&G industry assets are unique in that they are, in the main, held in Joint Assets No Entities (JANEs). In these JANEs, the majority or dominant stakeholder is able to exercise control over the development strategy of the oilfield asset. The majority

holder is therefore able to maximize corporate value - control and optimize cash flows. Oilfield NPV behavior is therefore uniquely asset based and controlled by majority or controlling asset stakeholders. It is, for example, precisely this control principle that is at the heart of the TNK-BP dispute, where BP and TNK each hold 50% of the venture, resulting in a strategic stalemate for the asset development. In O&G, minorities are exactly that - minorities with secondary influence over asset cash flows.

We show however that companies in the sector which seek to grow or sustain earnings are forced to replace consumed reserves by acquiring positions in foreign assets. They do this despite the fact that they are typically only able to acquire minority stakes in foreign assets - effectively relegating them to the position of junior partner in the assets. Like Rose (1996), who examines the apparently contradictory behavior of banks, we seek to examine and understand the contradictory behavior of O&G companies that acquire minority stakes in international assets.

Ownership ebbs and flows in international diversification have been well documented through studies examining the value of pay off (Berger and Ofek 1995; Comment and Jarrell 1995; Laeven and Levine 2007; Singh et al. 2003) and the the beneficial effect of geographic diversification on risk reduction by Rose (1996), but without due regard to the effects of diversification on asset control. Our resource sector study is characterized by two notable attributes that enable us to clearly identify the effect of diversification on asset control: the location of reserves enables us to isolate asset ownership structure by country; secondly, oil and gas are homogenous and non-renewable (Stiglitz 2007), enabling a global comparison of ownership. These attributes of location and homogeneity enable us to limit endogeneity and isolate country specific effects of international globalization on corporate assets.

Despite the above insights, the strategic resource extractive industry is neither efficient nor transparent in its market structure for oilfield assets. We know little about the ownership of these assets nor is there much research into these closely held assets. To complicate matters the sector is often subject to political, fiscal, and economic protectionism as companies seek control of the assets needed to sustain earnings (see Kretzschmar and Kirchner (2008)). The largest and most important oil and gas reserves are state owned, directly limiting corporate access to these (Victor 2007). Explicit limits to corporate geographic expansion have already been observed in the O&G sector with numerous host countries (Non OECD in particular) tend to retain control over domestic assets through national oil companies (Victor 2007). As result, corporates

compete for the balance of field assets in these countries (Krezschmar et al. 2009). Hence while we measure the average majority stake by company grouping, it is clear that NOCs dominate domestic holdings with an average of 57.59% of domestic fields. Because these NOCs control large fields they actually control 94.18% of domestic reserves. The main focus in this paper is therefore on the extent to which companies are able to attain control over non NOC oilfield cash flows, by gaining asset blockholdings greater than 25%. The 25% blockholding cut off we use in this paper is informed by the generally accepted industry practice that enables the operator involvement in the operation of the field.

Detailed global oilfield asset ownership data enable us to analyze the percentage of reserves owned outside the country of company's primary operation. Ownership of physical reserves entitles companies to oil revenues in proportion to their holdings in the field (see Errunza and Senbet (1984)). We perform an extended empirical analysis of international diversification effects on ownership and document that diversification is directly related to a reduction of control on internationally diversified assets. Domestic reserve holdings exceed foreign holdings, comprising 64.3% of company reserves owned, with the balance held in foreign reserves. This domestic bias is especially pronounced for NOCs, which own 94.2% of their physical reserve assets in their home countries. In contrast, we show that only 10.5% of the reserves owned by oil majors are domestic while 89.5% are foreign, a preponderance of foreign asset exposure that makes clear the extent of the globalization necessary for the largest oil and gas companies seeking reserve replacement.

Furthermore, we demonstrate that company control over domestic oil and gas assets exceeds that for foreign oilfield assets. Even the largest listed oil companies, oil majors, own on average 49.8% in domestic reserve assets but own on average only 35.6% in foreign fields. Listed NOCs on average own 57.6% of domestic fields and only 30.6% in foreign oilfields. Findings highlight the loss of oil field cash flow control that occurs with international diversification. Yet, despite the diminishing control over foreign oilfield cash-flows, diversifying companies seek to retain minimum blockholdings in their foreign assets. We show that 25.5% of domestic assets and even higher 32.6% of foreign assets are held in blockholdings. This trend is particularly pronounced for large cap majors for which 44.91% of foreign holdings are blockholdings vs only 10.18% of domestic reserve block holdings.

In conclusion, diversification in the oil and gas sector comes at an important and hitherto unmeasured cost, the loss of control over strategically important resource assets. Global insights demonstrate that control over asset cash flows commensurate to percentage stakes in oilfield assets diminishes with increasing geographic diversification, an outcome that stems primarily from new entrants inability to compete against host National Oil Companies. Importantly, we note that there is a lower limit to the oilfield asset ownership loss that diversifying companies are prepared to tolerate. This is reflected in the retention of minimum blockholdings (above 25%) in foreign oilfield assets.

II Data and Key Concepts

Our definitions of ownership rely on the sector principle that majority stake (or at least a minimum blockholding) is required to exercise control over oilfield cash flow, with majority stakeholders determining oilfield strategy and therefore NPV profile. Ownership attributable to cash flow rights has previously been emphasized in studies by Faccio and Lang (2002) and Holderness (2007). For the O&G industry, ownership of cash flows is commensurate to ownership in the field, but with blockholdings able to determine asset strategy. In this study *Ownership* therefore is measured as the percentage of remaining reserves attributable to company's holding. We therefore use percentage ownership and percentage stake terms interchangeably. A majority stake is defined as 50% ownership of the oilfield, while blockholdings are measured as 25% field ownership.

We analyze ownership in these categories for the three main groups of owners, *national oil companies*, *large cap majors*, and *North American and international independents (NAII)*. A *national oil company* is defined as a company, joint venture or organization owned by a government (Hartley and Medlock 2008), an *large cap major* category includes the 12 large cap integrated oil companies, engaged in the upstream O&G sector, as well as at least one other significant activity in the downstream sector and which are also classified as oil majors by the Society of Petroleum Engineers.[1] Companies that are not in the above categories are included in *NAII* category. Companies that are not publicly listed are not included in the study. This ensures that NOCs like Saudi Aramco, Emirates National Oil company seeking to maximize economic rents from domestic reserves do not bias the results of the study (Stiglitz 2007).

Global reserve and ownership data as at January 2008 are hand-collected and updated quarterly by specialist research teams through interviews with operating companies.[2] Global reserve data reflect the size of the remaining reserves of the fields and their ownership structures as year-end 2007. For example, as at 2007 the oil major Total owns a total of 364 stakes in oilfields globally with 34,866 million barrels of oil equivalent in physical reserves attributable to all stakes combined. We examine asset ownership of each company in the dataset. For example, if a company X owns 60% of company Y,

[1] 12 oil majors include BP, Chevron, ConocoPhillips, ENI, ExxonMobil, Hess, Marathon, Murphy Oil, Occidental, Petro Canada, Shell and Total

[2] Reserve and reserve ownership data are commercially available from the Energy Research House Wood Mackenzie

which in turn owns 30% of field Z, then we calculate that company X owns 18% of field Z. Using an example from the dataset, Repsol-YPF owns 66% of company Pluspetrol, which owns 55% of Block 1-AB field in Peru, we posit that Repsol-YPF owns 36.3% of field Block 1-AB. Our study uses only material oil field assets with a minimum of 5 million barrels of oil equivalent (mmboe) in remaining reserves. This lower limit to asset size enables us to overcome idiosyncracies associated with small oilfield assets previously identified by Kretzschmar and Moles (2006).

Table I presents the summary of reserve holdings across seven regions identified in this study owned by the listed oil and gas companies included in this study.

[Table I about here.]

With reference to Table I we start with a total population of 2,181 oil and gas companies owning a total of 8911 oilfields which account for 100% of global reserves and then use several filters to construct the dataset we use for this study. We select only listed firms to be included in our study and remove all private NOCs (which own a sizable majority of global reserves in the oil and gas sector) and other private unlisted oil and gas firms. Listed companies own a total of 6,633 stakes in oilfields worldwide comprising 902,983 mmboe of physical reserves, which account for 35% of world's total reserves (see Table I).

For the final dataset of 293 publicly listed firms market data and geography of primary listing are collected from Thomson Financial Datastream. We use market data for the year-end closest to December 31, 2007. We split reserve location into seven geographic oil producing regions where companies own oilfield assets: Africa, North America, South/Central America, Asia Pacific, Eurasia, Europe, and Middle East. This geographic segmentation into proximate regions allows us to measure the extent of company's international diversification based on the number of different regions where companies own oilfield assets. This global geographic metric is included in the variable description in Table IV.

III Geographic Diversification and Ownership

A Data Analysis - Domestic and Foreign Ownership

In Table II we compare ownership characteristics between foreign and domestic asset holdings for the complete dataset of listed O&G companies and for the three company groupings (*NOCs, Large Cap Majors, NAII*). Domestic reserves include reserves owned in the country of primary listing, whereas foreign reserves encompass ownership outside the country of primary listing. To capture the effect of economies of scale from operating large fields, we distinguish domestic and foreign involvement for large fields. Large fields in this study contain in excess of 60 million barrels of oil equivalent in remaining reserves. Differentiating between large fields and total ownership allows us to identify economies of scale as a separate explanatory variable used in the regression analysis and defined in Table IV. We adopt an analysis of blockholdings consistent with the ownership study by Holderness (2007). Ownership stakes are classified as blockholdings when ownership in a particular field exceeds 25% threshold.

[Table II about here.]

Figure 1a illustrates the percentage of reserves attributable to domestic and foreign reserve holdings. Figure 1b summarizes the average ownership in domestic and foreign oilfields calculated from the average stake size for each company in foreign and domestic fields. Figure 1c presents the proportion of reserves held in blockholdings, calculated as the number of blockholdings divided by the number of all oilfield stakes held by each company grouping and for the whole dataset. Data are interpreted below. From Table II and Figure 1a we observe that based on proportion of reserves held by all listed O&G companies, domestically owned reserves dominate foreign reserves. Domestic reserves comprise 64.3% of total reserves owned, with the balance encompassing foreign reserve holdings. This finding is particularly pronounced for *NOCs*, for which domestic reserves comprise 94.2% of the total reserves owned by NOCs. In contrast, only 10.5% of reserves owned by *large cap majors* are domestic and the remaining 89.5% are foreign, suggesting that the ownership structures for the 89.5% of foreign reserves is of critical and strategic importance.

[Figure 1 about here.]

With reference to Table II we find that across all listed companies average ownership in domestic and foreign assets is about the same. This equality in the average ownership stakes for the whole dataset is explained by the large number of NAII O&G companies dominating the dataset and for which average ownership stake size holds across domestic and foreign oilfields. By contrast, there is clear evidence illustrated in Figure 1b that *NOCs* reduce their average ownership stakes from 57.6% in domestic fields to 30.6% in foreign assets. Similarly, largest listed companies, *large cap majors*, are able to own on average 49.8% in domestic reserve assets and only 35.6% in foreign fields. Data for both company groupings suggest control over assets diminishes as a direct result of international diversification.

From Table II, the decline in ownership is particularly pronounced for average ownership in large foreign fields vs large domestic fields. The number of stakes in large fields on the contrary increases from domestic to foreign operations, suggesting that companies try to gain access to economies of scale derived from operating large fields; however, fierce NOC competition for large fields does not allow large ownership stakes in foreign markets.

Despite the dimunition in ownership of foreign assets, diversified listed companies strive to retain a minimum blockholding (25%) in international assets. Table II and Figure 1c demonstrate that companies have more blockholdings *outside* the country of primary listing compared to blockholdings in domestic oil field assets. This characteristic is most pronounced for *large cap majors* for which 44.9% of the ownership stakes are foreign blockholdings and only 10.2% are domestic blockholdings. For the population of listed oil and gas companies 32.6% of their foreign reserve holdings are blockholdings vs 25.5% of domestic blockholdings. The exception is demonstrated by *NOCs*, which enjoy privileged position in domestic markets resulting in majority, 64.9%, of all stakes owned by NOCs being blockholdings of domestic assets and only 14.4% blockholdings of foreign reserves.

B Diversification, Size, and Cash-flow Ownership

We seek to investigate the link between firm's geographic diversification, market size and control over its assets. Existing research uses different ways of measuring geographic diversification, we follow Rose (1996) and use a regional diversification measure, which simply counts the number of regions where the company owns oilfield assets.

We split companies into seven diversification bands according to the number of regions across which assets are diversified based on geographic proximity of the regions. Where one region signifies undiversified firm and seven regions reflect maximum level of geographic diversification. Table III presents the summary of company characteristics arranged according to the diversification bands.

Variables listed along the horizontal axis of Table III are split into three main categories, testing international diversification, size and reserve ownership structure. Previous studies have suggested multiple ways of measuring the degree internationalization, examples of most complete studies include Christophe and Lee (2001) and Sullivan (1994), who use percentage of foreign sales as a fraction of total sales, foreign assets as a percentage of total assets, foreign profit as a percentage of total profit and other parameters. We use the percentage of foreign reserves as a fraction of total reserves.

Size variables include average physical reserves owned by the companies, economies of scale and market capitalization (MC). Economies of scale are defined as the number of stakes owned in large fields divided by the total stakes count. Large fields are defined to be those in excess of 60 mmboe in remaining reserves.

[Table III about here.]

Table III Panel A summarizes listed companies, indicating a positive interaction between firm size and level of diversification, suggesting that large companies are more diversified. This positive relationship between size and level of diversification is strongest for the *large cap majors*. These are found to be diversified across at least three geographic regions. With reference to Table III the majority of all companies in the study are not diversified and own assets in a single region. Of 184 undiversified companies 180 are *NAII*, which include predominantly smaller cap independent oil and gas companies lacking financial resources to access foreign reserves. Similarly, for *NAII* summarized in Panel D of table III, the level of diversification also increases with size. The anomaly to this pattern is *NOCs*, which show no apparent linear relationship between geographic diversification and firm size (see Appendix VII for the details on regional diversification and firm level characteristics for each NOC). The reason for this anomaly is clear; if a country has large reserves its NOC is large as well.

All listed companies demonstrate decreasing control over oilfield assets with a reduction in average stake size with the average stake size of 43.6% for undiversified companies and lower 34.9% average stake size for highly diversified companies. Table

III illustrates that overall the relationship between diversification and asset control is strong for *NAII* and less for *large cap majors*. In Panel D of Table III the two companies diversified across all seven geographic regions in the *NAII* grouping deviate from this trend. These extreme observations are driven by large ownership stakes held by two large diversified companies BG and Anadarko. NOCs show no linear relationship between their level of diversification and asset ownership, an attribute we ascribe to the precondition of NOCs needing political alliances to enable NOCs' strategic resource acquisitions in foreign countries. This limitation of foreign entry was recently illustrated by the failure of the Chinese NOC CNOOC Ltd. effective takeover of the US California based firm Unocal forcing CNOOC Ltd to withdraw its 18.5 billion US dollar takeover bid. Washington argued that the deal would threaten US national security and violate the rules of fairtrade.[3]

From Table III we also observe the diminishing ability of *large cap majors* to access large foreign fields concurrent with increasing diversification. Table III shows that 100% of all stakes owned by least diversified *large cap majors* are held in large fields compared to only 78% of the stakes being in large fields for most diversified companies suggesting the decreasing economies of scale from diversification. This limitation to corporate access of large fields is perhaps explained by greater host country NOC awareness of the need to retain ownership of economic rents for strategically important assets, limiting opportunities for globalizing companies.

In summary, our data analysis shows limited evidence of a positive relationship between firm size and level of diversification and a negative relationship with asset control.

[3]Washington Post

IV Regression Analysis

1 Regression Model

We formulate a framework based on ordinary least squares (OLS) procedures to provide industry wide insights into the effect of diversification on asset control. Specifically, we construct two cross-sectional models to investigate the manner in which ownership structures vary across undiversified companies focused on a single region and internationally diversified firms. Using a combination of asset ownership characteristics consistent with prior corporate ownership studies by La Porta et al. (1999), we contruct two linear regressions of the form:

$$\text{Model 1: } \%\text{Ownership} = \alpha + \sum_{i=1}^{5} \beta_i X_i; \tag{1}$$

$$\text{Model 2: } \%\text{Blockholding} = \alpha + \sum_{i=1}^{5} \beta_i X_i; \tag{2}$$

where X_1 is the *Number of regions*, X_2 is the *%Foreign reserves*, X_3 is *Ln(Reserves)*, X_4 is *Economies of scale*, X_5 is *Ln(MC)*.

Consistent with the metrics we use in descriptive data analysis, the first measure reflects the average percentage of ownership in oilfield assets for each company and is denoted as *%Ownership*. We also use the number of blockholdings (25%) denoted as *%Blockholding* and defined as the ratio of blockholding stakes to the number of all stakes held by the company. We use logarithmic transformations of reserve size and market capitalization to mitigate the effect of extreme observations in reserve size and market capitalization. All remaining explanatory variables are defined consistent with definitions used in our descriptive data analysis.

All explanatory variables are grouped into two categories to control for diversification and size. Models 1 and 2 are designed to control for the two categories of explanatory variables; diversification and size, where Model 1 models average field ownership and Model 2 explains the blockholding stakes. Table IV provides detailed description of dependent and explanatory variables. Panel A describes the dependent variables mod-

eling average ownership and blockholdings, Panels B, and C provide definitions for explanatory variables isolating diversification and size, respectively.

[Table IV about here.]

Descriptive statistics for dependent and explanatory variables are summarized in Table V. We do not subdivide all listed companies into *NOCs*, *large cap majors* and *NAII* because *NOCs* and *large cap majors* company groupings do not provide sufficient numbers of observations to draw statistically meaningful conclusions. We test the robustness of the regression results by taking the subsets of large and small companies differentiated by firm market capitaliztion. Large companies include all firms with equal or above median market capitalization, small firms include remaining companies with market capitalization below the median. This size split is reflected in the summary of descriptive statistics for all variables in Table V presented in three different panels A, B, and C for the whole dataset of listed companies and large and small companies, respectively.

[Table V about here.]

2 Regression Results

Table VI presents the results of OLS estimated parameters of models 1 and 2 for all companies in the dataset. Results support the findings highlighted in univariate analysis (with reference to previously presented Table III) and illustrates the link between international diversification and deteriorating ownership. Results of OLS estimation on a subset of large and small companies are included as robustness tests.

[Table VI about here.]

Results presented for Model 1, controlling for diversification and size variables and modeling *%Ownership*, we observe a negative significant coefficient for the *Number of regions*, suggesting an adverse effect of increasing level of geographic diversification on average ownership. Contrary to previous observations from descriptive data analysis, *%Foreign reserves* has a positive significant loading, perhaps explained by the sensitivity of the model to extreme observations.

Regression parameters controlling for size are significant at 99% level for both models when regressed for the whole dataset (see Table VI). *Ln(Reserves)* captures the size

of total reserves owned by each company and shows positive relationship with *%Ownership*, suggesting that companies with a large existing reserve base tend to achieve higher ownership stakes and hence are able to control their assets. The factor loading for *Economies of scale* is negative and significant, suggesting that holdings in large fields are smaller. This is explained by fierce competition for participation in large fields and protective policies of the states with regard to large strategically important oil and gas reserves, discussed previously and summarized (see Table II). Consistent with the descriptive data analysis, *Ln(MC)*, the regression variable controlling for firm size, has a negative and significant coefficient, demonstrating that the level of diversification escalates with firm size but leads to the reduction of percentage of ownership in oilfield assets and therefore diminishing control over the oilfield cash flows. This finding shows sector evidence in support of the negative interaction between the firm size and the effect of geographic diversification on asset control.

Results for Model 2, where *%Blockholding* is regressed against variables identical to Model 1, all variable coefficients retain their sign and significance levels. The exception is the coefficient of *%Foreign reserves* for which significance level declines, suggesting a weaker relationship between the proportion of companies' foreign reserve holdings and field blockholdings. Similar to all previous results we observe negative significant interaction between the *Number of regions* and *%Blockholding*.

For robustness tests to verify our findings for the complete dataset of listed O&G companies we repeat the OLS procedures using the subsets of small and large companies sorted by market capitalization and repeat the OLS procedures. In Table VI we find that results achieved for the complete dataset of companies are robust for the two sub sets of data. For Model 1 we find strong evidence of a negative relationship between diversification and ownership, supporting our finding of the effect of diversification on company's diminishing control over oilfield assets. Size variables likewise retain their significance levels. In Model 2 the significance levels for diversification variables decline, however we still observe negative interaction between diversification and ownership, measured either by *%Ownership* or *%Blockholding*.

The robustness results for a subset of small companies are strong. The exception is firm size effect, measured by *Ln(MC)*, that loses its significance, suggesting that for small companies firm size effects are not sufficient to yield statistically significant results and affect ownership.

V Conclusion

The spread of international diversification has provided researchers with a puzzling question: why do large corporations continue to expand internationally if there is implied cost of diversification - a dimunition in control over assets. The results of this study suggest a possible answer to this research question: reserve replacement and hedging of political risk. We infer that these positive benefits associated with geographic expansion are sufficient to offset the loss of control over assets.

Firstly, we document that diversification is directly related to a reduction in ownership for diversified assets. Diversified companies are shown to be the largest listed companies in the oil and gas sector, suggesting a direct link between firm size and level of international diversification. Secondly, we examine the relationship between upper ownership limits of foreign assets from finding above with the minimum blockholding retained by corporates to secure foreign asset ownership. Our study demonstrates that international diversification comes with the important caveat that diversified companies strive to retain a minimum ownership blockholdings in international assets.

Interestingly our findings are supported by the fact that companies have more blockholdings *outside* the country of primary listing (compared to blockholdings in domestic oil field assets). This characteristic is again most pronounced for large integrated oil companies, for which 44.9% of all ownership stakes are foreign blockholdings with only 10.2% in domestic assets. An exception is NOCs, which enjoy privileged position in domestic markets resulting in majority, 64.9%, of all stakes owned by NOCs being domestic blockholdings with only 14.4% blockholdings in foreign reserves. This work provides industry wide evidence of the implied cost of international diversification. We suggest that future research into the value of diversification will provide rich insights into the value effects control losses associated with international diversification.

A Appendix - Regional and country reserve data

[Table VII about here.]

List of Figures

List of Tables

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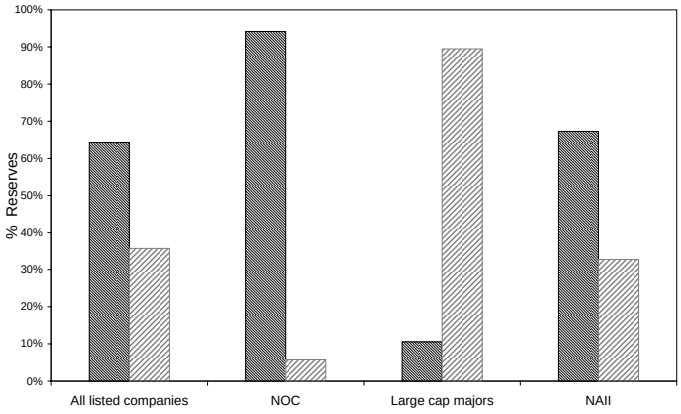
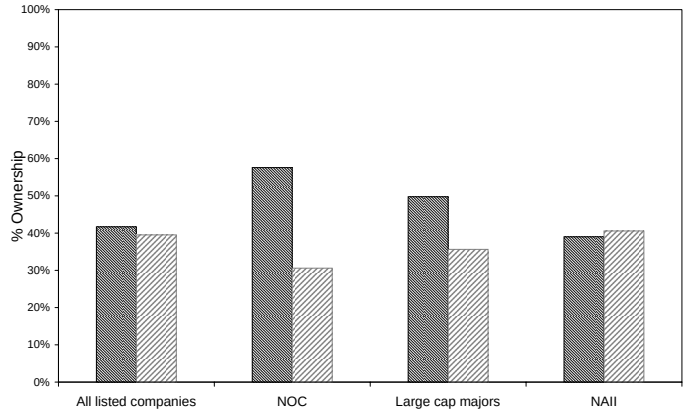
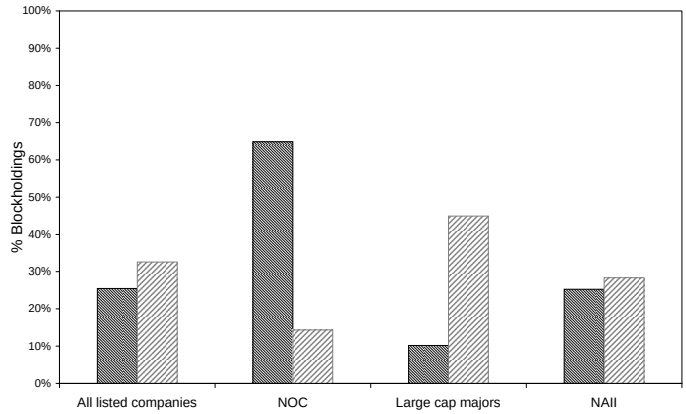


(a) Domestic and Foreign reserve holdings



(b) Ownership in domestic and foreign fields



(c) Domestic and foreign blockholdings

Figure 1. Domestic and foreign reserve ownership and blockholdings at 2007

Figures 1a-1c present a graphical summary of the comparisons of domestic and foreign reserve holdings, average reserve ownership, and blockholdings. Figure 1a illustrates the percentage of reserves attributable to domestic and foreign reserve holdings. For example, third set of bars in Figure 1a demonstrates that only 10.5% of the reserves owned by *large cap majors* are domestic and 89.5% are foreign reserves. Figure 1b summarizes the average ownership in domestic and foreign oilfields calculated from the average stake size for each company in foreign and domestic fields. The third set of bars in Figure 1b illustrates that *large cap majors* ownership on average 49.8% of the reserves in domestic fields and only 35.6% of the reserves in foreign fields. Figure 1c presents the number of blockholdings as a proportion of total stakes owned by the companies, demonstrating that blockholdings owned by *large cap majors* predominantly consist of foreign blockholdings, which when read together with 1a and 1b suggests that despite the preponderance of foreign reserves, average ownership is low, but blockholdings are retained.

Table I Geopolitical Overview of Reserve Ownership

The Table presents the companies' reserve holdings by geographic region. This study divides world reserves into seven regions including Africa, North America, South/Central America, Asia Pacific, Eurasia, Europe and Middle East, all listed along the vertical axis in the table. Oilfield locations are grouped into regions on the basis of geographic proximity. The table differentiates between 'All companies' and 'Listed companies', which are included in the study. We present total number of companies, reserve ownership in mmboe and as a percentage of global reserves for all O&G companies and only listed O&G companies. Subsidiaries' reserves are consolidated with parent companies and companies with no reserves are excluded from ownership analysis. Listed companies own 35% of global reserves, the remaining 65% are controlled by unlisted National Oil Companies which do not disclose reserve and market data. Number of fields presented for 'All companies' reflects the total number of oil fields above 5 mmboe globally, where the number of stakes for 'All Listed Companies' reflects the number of oil field stakes owned by listed companies, which does not reconcile to the number of distinct oilfields. Ownership reflects the percentage of remaining reserves listed company owns in a given field.

	Region	All Companies Ownership				Listed Companies Ownership				
		N	Reserves		Fields	N	Reserves		Stakes	Ownership
			(mmboe)	% Global Reserves	N		(mmboe)	% Global Reserves	N	%
	Global	2181	2575743	100%	8911	337	902982.5	35.06%	6633	42.93%
1	Africa	474	175830.9	6.8%	1977	3	76103.17	2.95%	1428	39.39%
2	North America	355	132383.8	5.1%	1184	183	127300.9	4.94%	1155	17.40%
3	South/Central America	248	426379.4	16.6%	913	3	56455.36	2.19%	470	40.67%
4	Asia Pacific	331	88025.81	3.4%	1171	64	65813.35	2.56%	990	34.07%
5	Eurasia	351	662963.3	25.7%	1926	19	485665.9	18.86%	1071	61.87%
6	Europe	275	58326.01	2.3%	1058	59	35175.35	1.37%	926	44.42%
7	Middle East	147	1031834	40.1%	682	6	47479.4	1.84%	218	50.47%

Table II Domestic and Foreign Acquisitions and Reserve Ownership

The table presents the summary of reserve ownership grouped into total, domestic and foreign reserves and differentiated by company type. We demonstrate the comparative summary of domestic and foreign reserves owned by the companies: physical reserves attributable to companies' holdings globally, domestic by primary listing and foreign, outside of home country. Reserves reflect physical reserves in mmboe and percentage of domestic and foreign reserves relative to reserves owned globally. Ownership reflects the average ownership across all fields owned by the companies; ownership in large fields reflects average ownership in fields that by definition of large fields exceed 60 mmboe in remaining reserves; number of stakes reflects total count of stakes owned by the companies; number of stakes in large fields in absolute and percentage terms as a fraction of total number of stakes attributable to the companies. Blockholdings reflect the number of stakes which own in excess of 25% of the field. %Blockholdings reflects the number of blockholding stakes as a fraction of the total number of stakes owned by the company. All variables are grouped according to company groupings, including a summary for all listed companies, *National Oil Companies*, *large cap majors* and *North American and International Independents*.

	Listed Companies			Listed NOCs			Large Cap Majors			NAII		
	Total	Dom	Foreign	Total	Dom	Foreign	Total	Dom	Foreign	Total	Dom	Foreign
Reserves (mmboe)	902983	580264	322718	444649	418785	25864	258713	27247	231465	199621	134232	65390
% of Global holdings		64.26%	35.74%		94.18%	5.82%		10.53%	89.47%		67.24%	32.76%
%Ownership	40.69%	41.69%	39.52%	42.71%	57.59%	30.59%	36.70%	49.76%	35.63%	40.72%	39.00%	40.57%
%Ownership (Large fields)	41.13%	48.86%	36.35%	43.36%	54.30%	32.48%	38.40%	43.91%	38.09%	41.07%	48.32%	36.66%
Number of fields	6633	2609	4024	1002	709	293	2534	418	2116	3097	1482	1615
Number of large fields	2248	808	1440	512	363	149	940	116	824	796	329	467
Large fields (%)	33.89%	12.18%	21.71%	51.10%	36.23%	14.87%	37.10%	4.58%	32.52%	25.70%	10.62%	15.08%
Blockholdings	3852	1691	2161	794	650	144	1396	258	1138	1662	783	879
%Blockholdings	58.07%	25.49%	32.58%	79.24%	64.87%	14.37%	55.09%	10.18%	44.91%	53.66%	25.28%	28.38%

Table III Diversification

The diversification level of 293 companies in the study is measured by the number of regions where the company owns oilfield assets. All companies are classified into 7 diversification bands. Companies which are not diversified, own assets within a single region, are included in band 1. Companies which own assets across all seven geographic regions are included in diversification band 7 respectively. Size category variables listed on the horizontal axis of the table include average physical reserves owned by the companies; scale economies reflecting the average count of stakes owned in large fields as a proportion of total number of stakes owned by each company, and an average market capitalization (MC). The table is split into Panels to demonstrate diversification level for all listed companies in the study in Panel A and for listed *NOCs*, *large cap majors* and *NAII* in Panels B, C, and D, respectively.

Diversification			Size			Ownership structure	
Regions N	Companies N	%Foreign Reserves	Reserves	Economies of Scale	MC	%Ownership	%Blockholdings
Panel A: All Listed Companies - 293							
1	184	67%	22877	30%	4059309	43.59%	57.59%
2	50	48%	204028	29%	10259710	36.30%	50.87%
3	17	36%	507074	25%	25959168	37.73%	56.15%
4	15	47%	544494	33%	23891408	36.92%	52.73%
5	12	59%	3506427	47%	49880004	38.84%	55.55%
6	6	100%	413637	67%	43387396	30.68%	56.40%
7	9	58%	1427725	16%	183018445	34.99%	57.87%
Panel B: Listed NOCs - 20							
1	4	25%	5085	25%	1024510	24.96%	35.12%
2	4	60%	2095745	60%	30710711	38.63%	37.50%
3	3	50%	1446109	50%	56575033	57.79%	71.35%
4	4	48%	137099	48%	21784029	36.16%	49.31%
5	4	41%	10478154	41%	108927672	55.09%	77.25%
6	1	0%	2041549	0%	99035341	36.61%	35.72%
7	0	0%	0	0%	0	0	0
Panel C: Large cap majors - 12							
1	0	0%	0	0%	0	0	0
2	0	0%	0	0%	0	0	0
3	1	100%	57231	100%	32335700	35.83%	62.90%
4	2	95%	1052643	95%	44909185	41.09%	68.87%
5	1	94%	64078	94%	16056640	41.33%	42.86%
6	1	96%	35244	96%	32335700	37.22%	59.15%
7	7	78%	1815716	78%	219984019	32.81%	56.14%
Panel D: NAII - 261							
1	180	67%	23272	28%	4126749	44.01%	58.09%
2	46	37%	39531	26%	8481362	36.10%	52.03%
3	13	55%	324977	41%	17565629	32.87%	52.12%
4	9	78%	612637	51%	20157404	36.33%	50.66%
5	7	100%	14347	48%	20970389	27.59%	44.97%
6	4	31%	101257	28%	32238333	27.63%	54.73%
7	2	50%	69757	0%	53638936	42.61%	63.91%

Table IV Variable Definitions

The table illustrates explanatory variables used for linear regressions with OLS estimates on firm level variables, CCAR and 1-year $\overline{\Phi}_i$, and on deal level 1-year $\widehat{\Phi}_j$.
This table presents the definitions and sources of dependent and explanatory (independent) variables used in this study.

Variable	Notation	Description
		Panel A: Dependent Variables: Ownership structure
%Ownership		Percentage ownership in oilfield assets, measure to capture ownership structure similar to the measures used to study the relationship between the methods of diversification and ownership structure in Ruiz-Moreno et al. (2007) *Source: Wood Mackenzie, ownership data as of 2007.*
%Blockholding		Number of blockholding stakes divided by the number of all stakes owned by the company. Ownership stake in excess of 25% of the field reserves is classified as blockholding. Use of blocholding is informed by Holderness (2007) study of ownership. *Source: Wood Mackenzie, ownership data as of 2007.*
		Panel B: Explanatory Variables: Diversification
Number of regions	X_1	A regional diversification measure consistent with Rose (1996), which simply counts the number of regions where the company owns oilfield assets. There is a total of seven regions the companies can diversify their asset holdings across, grouped on the basis of geographic proximity. *Source: Wood Mackenzie, ownership data as of 2007.*
% Foreign reserves	X_2	Percentage of foreign reserves as a fraction of total reserves owned by the company. Variable isolates the contribution from assets outside of country of primary listing; Rose (1996) uses percentage of foreign assets; Singh et al. (2003) use foreign sales/total sales to capture similar effects. *Source: Wood Mackenzie, ownership data as of 2007.*
		Panel C: Explanatory Variables: Size
Ln (Reserves)	X_3	The natural logarithm of each company's total reserves We use natural logarithm to mitigate the effect of extreme observations in reserve size. *Source: Wood Mackenzie, ownership data as of 2007.*
Economies of scale	X_4	Number of stakes owned in large fields divided by the total stakes count owned by the company. Large fields include oil and gas fields in excess 60 mmboe. *Source: Wood Mackenzie, ownership data as of 2007.*
Ln (MC)	X_5	The natural logarithm of each company's market capitalization (millions USD) to isolate firm size effect. *Source: Thomson Financial Datastream.*

Table V Descriptive statistics - Dependent and explanatory variables

Table V reports descriptive statistics of dependent and explanatory variables used in the models for 293 listed oil companies. The table differentiates between dependent and explanatory variables, where explanatory variables are grouped into diversification and size variables. Both dependent variables including *%Ownership* and *%Blockholding* reflect ownership data. *%Ownership* reflects the average percentage participation in oilfield assets by each company. Percentage of blockholding is calculated by the ratio of blockholding stakes to the total number of stakes that the company owns. The company is a blockholder when it owns more than 25% of a field. *Number of regions* is used to measure the level of geographic diversification. *% Foreign reserves* is another variable used in the model to isolate asset ownership outside of host country according to company's primary listing. *Ln(Reserves)* captures asset size, *Economies of scale* enables us to isolate ownership in large fields and reflects the number of stakes in large oilfields as a fraction of total number of stakes for each company. *Ln(MC)* captures firm size of the listed companies (by market capitalization). Additionally, market capitalization allows us to split the population of listed companies into large and small companies, where large companies are defined to be listed O&G companies with market capitalization above the median for the whole population of companies in the study.

	Dependent Variables		Explanatory Variables				
	Ownership structure		Diversification		Size		
	%Ownership	%Blockholding	Number of regions	% Foreign reserves	Ln(Res)	Economies of Scale	Ln(MC)
			Panel A: All listed companies				
Mean	41%	56%	2	61%	4.554328	31%	14.01
Median	34%	59%	1	96%	4.312067	25%	13.89
Minimum	0%	0%	1	0%	-1.87568	0%	4.25
Maximum	100%	100%	7	100%	12.52834	100%	20.05
StDev	28%	38%	2	46%	2.6966	33%	2.57
N	293	293	293	293	293	293	293
			Panel B: Large companies $[MC \geq Median(MC)]$				
Mean	38%	52%	3	61%	5.99	0.37	16.13
Median	33%	51%	2	91%	6.05	0.33	15.93
Minimum	1%	0%	1	0%	-1.08	0.00	13.95
Maximum	100%	100%	7	100%	12.53	1.00	20.05
StDev	26%	34%	2	44%	2.74	0.30	1.47
N	146	146	146	146	146	146	146
			Panel B: Small companies $[MC < Median(MC)]$				
Mean	43%	60%	1	61%	3.13	0.25	11.90
Median	35%	67%	1	100%	3.36	0.00	12.28
Minimum	0%	0%	1	0%	-1.88	0.00	4.25
Maximum	100%	100%	4	100%	6.80	1.00	13.89
StDev	30%	41%	0	47%	1.73	0.36	1.41
N	147	147	147	147	147	147	147

Table VI Linear Regressions Analysis - Control

This table reports the estimated coefficients and associated test statistics (in parentheses) of linear regression with OLS estimators of the following form:

$$\begin{aligned} &\text{Model 1:} \quad \%Ownership = \alpha + \textstyle\sum_{i=1}^{5} \beta_i X_i \\ &\text{Model 2:} \quad \%Blockholding = \alpha + \textstyle\sum_{i=1}^{5} \beta_i X_i \end{aligned} \tag{3}$$

The explanatory variables include the *number of regions* where the company owns reserves; *%Foreign Reserves* as a fraction of total reserves owned by the company. *Ln(Reserves)* is the natural log of total reserves attributable to company's stake holdings. *Economies of scale* is the count of stakes in large fields as a proportion of total stakes owned. *Ln(MC)* is the natural log of market capitalization. Parameter significance at a 90%, 95% and 99% levels are indicated are indicated by *, ** and ***, respectively.

Linear Regression		All Listed companies		Large companies $[MC \geq Median(MC)]$		Small companies $[MC < Median(MC)]$	
OLS Estimates		Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Intercept		0.603***	0.975***	0.871***	1.299***	0.317	0.643**
		(6.127)	(7.343)	(3.319)	(3.899)	(1.617)	(2.269)
Diversification	X_1	-0.076***	-0.069***	-0.039***	-0.033	-0.196***	-0.194***
		(-5.403)	(-3.647)	(-2.397)	(-1.582)	(-3.884)	(-2.670)
%Foreign reserves	X_2	0.079**	0.087*	0.026	0.043	0.088*	0.092
		(2.204)	(1.820)	(0.493)	(0.639)	(1.835)	(1.333)
Ln(Reserves)	X_3	0.081***	0.105***	0.067***	0.094***	0.099***	0.117***
		(8.817)	(8.447)	(5.910)	(6.501)	(6.350)	(5.236)
Economies of scale	X_4	-0.148***	-0.213***	-0.057	-0.168*	-0.233***	-0.262***
		(-2.969)	(-3.171)	(-0.815)	(-1.888)	(-3.384)	(-2.628)
Ln(MC)	X_5	-0.030***	-0.054***	-0.049***	-0.076***	0.003	-0.015
		(-3.548)	(-4.646)	(-2.658)	(-3.251)	(0.195)	(-0.587)
R sq		0.22	0.20	0.227	0.269	0.296	0.196
Adj R sq		0.21	0.19	0.199	0.242	0.271	0.167
N		293	293	143	143	147	147

Table VII Reserve Ownership and Financial Ratios: NOCs

This table presents the diversification level of 20 NOCs in the study, measured by the number of regions where the company owns oilfield assets. Reserve holdings reflect the amount of remaining physical reserves attributable to each company's field holdings. We use 7 regions to measure the geographic spread of the reserve holdings. Companies are classified into 7 diversification bands. Companies which are not diversified, own assets within a single region. Companies which own assets across all seven geographic regions are included in diversification band 7 respectively. We also include the average ownership percentage for the companies across all field holdings for that company. %Blockholdings is defined as the number of blockholdings as a percentage of all stakes owned by the company. We also list the market capitalization of the NOC in million USD.

NOC	Reserve holdings	Regions N	%Ownership	% Blockholding	Capitalization
Pakistan Oilfields	1,580.76	1	37.44%	57.14%	1033362
Lion Energy	0.31	1	2.50%	0.00%	9582
Pakistan Petroleum†	18,587.33	1	49.89%	83.33%	2976577
PNOC	172.62	1	10.00%	0.00%	78519
Hellenic Petroleum	613.88	2	41.82%	27.27%	5027066
Indian Oil Corporation	22.43	2	18.75%	0.00%	10736378
Rosneft	8,382,003.61	2	76.10%	97.73%	101404161
GAIL India	338.70	2	17.86%	25.00%	5675237
PTTEP	94,931.10	3	45.22%	56.00%	18238664
Petrobras	4,219,644.03	3	81.55%	93.33%	149719337
Petronas	23,750.96	3	46.59%	64.71%	1767097
CNPC (Hong Kong)	509.17	4	26.15%	33.33%	3098802
CNOOC Ltd	545,315.50	4	72.75%	93.90%	75409738
JAPEX	2,101.70	4	20.88%	20.00%	4282103
SINOCHEM	467.89	4	24.87%	50.00%	4345474
ONGC	542,246.13	5	49.13%	64.86%	43205452
Gazprom	4.00E+07	5	82.51%	98.93%	333559400
Sinopec	252,476.54	5	44.50%	79.63%	23733799
PetroChina	1,161,067.77	5	44.23%	65.57%	35212036
StatoilHydro	2,041,549.00	6	36.32%	60.32%	99035341

†Pakistan Petroleum does not disclose its financial data, however, we include the company in the analysis as reserve ownership data is commercially available